Nicotine & Tobacco Research, Volume 11, Number 7 (July 2009) 886–895

Original Investigation

Consumer awareness and attitudes related to new potential reduced-exposure tobacco product brands

Mark Parascandola, Erik Augustson, Mary E. O'Connell, & Stephen Marcus

Abstract

Introduction: In recent years, there has been a proliferation of potential reduced-exposure tobacco products (PREPs) marketed that claim to be less harmful or less addictive, compared with conventional cigarettes. Tobacco control scientists have raised concerns about the potential adverse impact of marketing of these products for smoking prevention and cessation efforts. Although these products have not been widely used among smokers, there are few data available on consumers' awareness and attitudes toward these products.

Methods: Data were obtained from the 2003 and 2005 Health Information National Trends Survey, a nationally representative telephone survey of adults 18 years and older regarding health communication and associated beliefs and behaviors. Our study population consisted of 6,369 respondents in 2003 and 5,586 respondents in 2005, of whom 19% were current smokers and 28% were former smokers.

Results: In 2005, 45% of respondents had heard of at least one PREP product, while only 4.8% had actually tried one. Awareness and use were substantially higher among current smokers (55.6% and 12.7%). Awareness was highest for Marlboro Ultra Smooth (MUS) (30.2%), Eclipse (18.2%), Quest (7.8%), and Ariva (5.4%), while less than 2% for any other product. Of respondents who had tried a PREP, 50% cited harm reduction or assistance in quitting as a reason for trying the product and 30% believed that the product was less harmful than their usual brand. In the combined 2003 and 2005 dataset, 54.4% of current smokers stated that they would be "very" or "somewhat" interested in trying a cigarette advertised as less harmful, while only 3.2% of former smokers and 1.1% of never-smokers were interested. Among current smokers, interest was higher in females and non-Hispanic Whites, and among daily smokers, those who smoked 20 or more cigarettes per day and those who were not considering quitting. Smokers interested in PREPs were substantially more likely to rate their perceived lung cancer risk as high (40.3% vs. 8.3%) and to worry frequently about developing lung cancer (19.7% vs. 4%).

Discussion: These results suggest that there is a substantial level of interest among current smokers in cigarettes marketed with claims of reduced exposure or harm. Of particular concern is that "health conscious" smokers and heavy smokers not planning to quit may be especially vulnerable to PREP marketing messages and view such products as an alternative to smoking cessation.

Introduction

In recent years, tobacco product manufacturers have introduced a range of new potential reduced-exposure tobacco products (PREPs), marketed as an alternative to conventional cigarettes with advertising claims or suggestions that they are less harmful than traditional cigarettes or reduce exposure to toxic constituents in tobacco and smoke. These new products include modified tobacco cigarettes (e.g., Advance, Omni), cigarette-like products (e.g., Eclipse, Accord), and oral/smokeless tobacco products (e.g., Ariva, Exalt, Revel) (Pederson & Nelson, 2007). Currently, evidence is insufficient to determine whether these products result in meaningful reductions in risk or exposure compared with conventional tobacco products (Stratton, Shetty, Wallace, & Bondurant, 2001). Moreover, the marketing of PREPs poses substantial challenges for tobacco control efforts as tobacco control advocates and public health experts have raised concerns that these products may serve as an alternative to

Mark Parascandola, Ph.D., M.P.H., *Division of Cancer Control and Population Sciences, National Cancer Institute, National Institutes of Health, Bethesda, MD*
Erik Augustson, Ph.D., M.P.H., *Division of Cancer Control and Population Sciences, National Cancer Institute, National Institutes of Health, Bethesda, MD*
Mary E. O'Connell, M.A., *Division of Cancer Control and Population Sciences, National Cancer Institute, National Institutes of Health, Bethesda, MD, and SAIC-Frederick, Inc., Clinical Monitoring Research Program, National Cancer Institute, Bethesda, MD*
Stephen Marcus, Ph.D., *Division of Cancer Control and Population Sciences, National Cancer Institute, National Institutes of Health, Bethesda, MD*

Corresponding Author:
Mark Parascandola, *Tobacco Control Research Branch, National Cancer Institute, 6130 Executive Boulevard, Room 4039, Bethesda, MD 20892-7337, USA. Telephone: 301-496-8584; Fax: 301-496-8675; E-mail: paramark@mail.nih.gov*

doi: 10.1093/ntr/ntp082
Advance Access publication on June 18, 2009
Received April 15, 2008; accepted November 6, 2008
Published by Oxford University Press on behalf of the Society for Research on Nicotine and Tobacco

cessation for smokers or as a gateway to tobacco use initiation among nonusers (Joseph, Hennrikus, Thoele, Krueger, & Hatsukami, 2004; Martin, Warner, & Lantz, 2004; Warner & Martin, 2003). Indeed, past experience with "light" and "ultra-light" cigarettes demonstrates how smokers may switch to a new brand with an expectation of health benefit, possibly instead of quitting (Borland et al., 2004; Cummings, Hyland, Bansal, & Giovino, 2004; Kozlowski et al., 1998; Shiffman, Pillitteri, Burton, Rohay, & Gitchell, 2001). While smokers continue to believe that low-tar cigarettes are less harmful (Borland et al.; Cummings et al.; Shiffman et al., 2001), epidemiologic studies have failed to show any substantial benefit for smokers who switched from full-flavor to low-tar brands (National Cancer Institute, 2001).

Because PREPs are relatively new and have had only a modest presence in the market, few published data are currently available about prevalence of use and consumer interest. Previous studies have shown that smokers are interested in trying PREPs and/or perceive them to have lower health risks, even when advertising messages do not make explicit health claims (Caraballo, Pederson, & Gupta, 2006; Hund et al., 2006; O'Connor, Hyland, Giovino, Fong, & Cummings, 2005; Shiffman, Pillitteri, Burton, & Di Marino, 2004; Shiffman et al., 2001). However, most of these products have had limited availability and marketing and currently appear to have limited popularity among smokers (Caraballo et al.; Hickman et al., 2004). To date, only one study has provided national data on prevalence of use or product awareness across a range of specific PREP brands and that study was limited to four brands (Hund et al.). Additionally, there are no available data on how smokers' interest in PREPs corresponds to general attitudes about disease prevention and health promotion.

To address this research gap, questions were added about PREPs to a nationally representative survey of U.S. adults administered at two timepoints in 2003 and 2005. Using data from this survey, we sought to address two major aims: first, to provide national estimates of the prevalence of awareness and use of PREP by brand, as well as consumer interest in using PREPs and second, to identify correlates of interest in order to understand who is most likely to be interested in PREPs (i.e., demographics and tobacco use behaviors) and why they are interested (i.e., health concerns and consumer attitudes perceptions regarding different tobacco products). This study provides baseline information for ongoing monitoring of awareness, use, and interest in PREPs.

Methods

Data source and sample

Data for the study were obtained from the National Cancer Institute's Health Information National Trends Survey (HINTS) (Health Communication and Informatics Research Branch of the Division of Cancer Control and Population Sciences, 2009). HINTS is a nationally representative telephone survey of adults designed to obtain population-based data on health information and health communication; cancer-related knowledge, attitudes, and beliefs; and primary and secondary cancer risk factors (e.g., smoking, physical activity, cancer screening behavior). The survey, scheduled to be conducted every 2 years, will be used by the National Cancer Institute to monitor changes among the public in the use of cancer-related information.

In this study, we analyze data from two iterations of HINTS for which data are currently available. Data were collected for the first iteration (HINTS 2003) between October 2002 and April 2003 and for the second iteration (HINTS 2005) between February and August 2005. Respondents were selected using random digit dialing. To ensure adequate representation from the two largest minority groups in the United States, telephone exchanges with high concentrations of Hispanic and Black residents were oversampled. Response rates were 55% for HINTS 2003 and 34% for HINTS 2005 at the household screening level and 62.8% for HINTS 2003 and 61.3% for HINTS 2005 at the selected participant, extended interview level. These are typical of response rates found in other national telephone surveys on health (Chang & Krosnick, 2002). Details of this survey and sampling design have been published elsewhere (Nelson et al., 2004), and more extensive information, including the survey instruments and datasets, is available on the HINTS Web site (http://hints.cancer.gov/).

The HINTS 2003 sample consisted of a total of 6,369 adults, including 1,246 (20% of those who reported their smoking status) current smokers and 1,681 (27%) former smokers. The HINTS 2005 sample consisted of 5,586 adults, including 1,015 (18%) current smokers and 1,599 (29%) former smokers (percentages calculated unweighted based including only those who answered the smoking status questions in the denominator). Characteristics of the samples for both 2003 and 2005 are described in Table 1.

Definitions and measures

There was question variation across HINTS 2003 and 2005 in response to time constraints or adaptation to ongoing experience with the survey questions. In this section, we describe the question items that we relied on in the analysis, and we specify who the respondents were in cases where only part of the sample received the question.

Awareness and use. Questions about awareness and use of PREPs were asked differently in HINTS 2003 and 2005 and are described in Table 2. Awareness was not measured in HINTS 2003, but in HINTS 2005, all respondents were asked if they had heard of specific PREP brands. In HINTS 2005, respondents were told that they would be asked some questions about "new types of tobacco products that have been recently introduced." They were then asked if they had heard of each of the following products in order: "Eclipse, Quest, MUS, Ariva, and Revel." Respondents were then asked whether they had heard of any other types of new tobacco products specified by the interviewer: "these would include products like Accord, Advance, Omni, Exalt, and Stonewall." If yes, then respondents were asked, for each of these brands, whether they had heard of the product. Respondents could also name any other new tobacco products they had heard of. To identify any potential correlates of awareness, we created cross tabulations for awareness (of any PREP) with several demographic variables, including employment status, education level, age, gender, and race/ethnicity. Because MUS entered test markets while the HINTS 2005 survey was in the field (O'Connell, 2005), we compared awareness of MUS in test market zip codes (Atlanta, Tampa, and Salt Lake City) versus

Table 1. Respondent sociodemographic characteristics: HINTS 2003 and 2005

	HINTS I		HINTS II	
	Counts	% (*CI*)	Counts	% (*CI*)
Total	6,369	100	5,586	100
Gender				
Male	2,521	48.1 (48.0, 48.2)	1,929	48.1 (48.1, 48.1)
Female	3,848	51.9 (51.8, 52.0)	3,657	51.9 (51.9, 51.9)
Age group (years)				
18–34	1,655	31.2 (30.8, 31.6)	1,037	31.0 (30.7, 31.4)
35–49	1,954	31.0 (30.7, 31.4)	1,490	30.1 (29.7, 30.5)
50–64	1,492	21.5 (21.1, 21.9)	1,522	22.8 (22.5, 23.1)
65–79	943	12.9 (12.4, 13.3)	1,122	12.6 (12.2, 13.0)
80+	299	3.4 (3.1, 3.8)	397	3.5 (3.1, 3.9)
Race/ethnicity				
White, non-Hispanic	4,276	71.8 (70.9, 72.6)	4,103	69.9 (68.5, 71.2)
Black, non-Hispanic	716	10.5 (10.1, 10.9)	438	10.0 (9.1, 11.0)
Hispanic	764	11.7 (11.4, 12.0)	496	13.0 (12.0, 14.0)
Other, non-Hispanic	312	6.0 (5.3, 6.8)	299	7.1 (6.1, 8.4)
Household income				
Less than $25,000	1,709	29.1 (27.6, 30.6)	1,307	25.8 (24.0, 27.7)
$25,000 to <$50,000	1,745	30.7 (29.0, 32.5)	1,217	24.9 (23.0, 26.8)
$50,000 to <$75,000	955	17.4 (16.3, 18.6)	924	21.5 (19.6, 23.5)
$75,000 or more	1,214	22.7 (21.6, 24.0)	1,150	27.8 (25.8, 29.5)
Education				
Less than high school	747	16.9 (16.6, 17.2)	687	14.5 (13.9, 15.1)
High school graduate	1,828	32.0 (31.6, 32.3)	1,447	29.9 (29.0, 30.8)
Some college	1,637	26.8 (26.5, 27.1)	1,545	32.2 (31.1, 33.2)
College graduate	1,927	24.3 (24.0, 24.6)	1,696	23.5 (23.0, 23.9)

Note. HINTS = Health Information National Trends Survey.

other areas of the country; The U.S. Postal Service Zip Code Lookup web tool was used to identify zip codes associated with the three test market cities to match up with zip codes in the HINTS dataset (United States Postal Service, 2007).

Use was measured in both surveys but in different formats. In HINTS 2003, current and former smokers were asked about PREP use in two questions. First they were asked: "Tobacco companies have recently introduced new types of cigarettes that are claimed to have fewer harmful chemicals or carcinogens. These have names like Eclipse, Accord, Advance, and Omni. Have you ever tried one of these products?" (YES/NO). Then they were asked: "Tobacco companies have also recently introduced new types of smokeless tobacco products. These have names like Arriva, Exalt, and Revel. Have you ever tried one of these products?" (YES/NO). In HINTS 2005, respondents who reported that they had heard of one or more specific PREP products were asked, for each of these products, whether they had tried them (YES/NO).

For HINTS 2003, respondents were considered to have tried a PREP if they answered "yes" to either PREP question (for cigarette or smokeless tobacco products). To analyze prevalence and use of PREPs overall in HINTS 2005, we created dichotomous indicators to represent those who reported they had tried any product versus those who had not tried any product. A similar variable was created for awareness of any product. In order to keep the population consistent across the two survey waves, this analysis was limited to current smokers and former smokers who quit less than 5 years ago. For those who had actually tried a PREP, HINTS 2005 included additional questions about use of the product. One or two products were selected from those the respondent reported having tried to ask the following questions about. Respondents were asked whether they now use the product (every day, some days, or not at all) and whether they smoked less, more, none, or about the same amount of their usual brand while using the product. They were also asked what their main reason for using the PREP was. We collapsed these responses into the following three categories: reduce harm or exposure (e.g., reduce health risk, less tar), to help quit smoking, and other reasons (e.g., taste, curiosity, cost).

Interest. In HINTS 2003, interest in PREPs was asked of current and former smokers, while in HINTS 2005, it was asked of all respondents. In both waves, the question was the same: "If a new cigarette were advertised as less harmful than current cigarettes, how interested would you be in trying it?" (very interested, somewhat interested, not interested). Because the question was identical in HINTS 2003 and HINTS 2005, we combined the two datasets to analyze correlates of interest. Interest was collapsed into a dichotomous variable (very or somewhat interested vs. not interested). Because interest was very low among former and never-smokers and because smoking status is associated with some of the demographic variables in the analysis, we limited this part of the analysis to current smokers only. Only a small number of respondents had ever tried these new tobacco products, so we did not do a similar analysis for correlates of product use.

Table 2. Survey makeup of questions regarding awareness and use of PREPS: HINTS 2003 and 2005

	HINTS I, respondents	HINTS II, respondents
Q. If a new cigarette were advertised as less harmful than current cigarettes, how interested would you be in trying it? Would you say …	Current and former smokers	All respondents
Very interested		
Somewhat interested		
Not interested		
Q. Tobacco companies have recently introduced new types of cigarettes that are claimed to have fewer harmful chemicals or carcinogens. These have names like Eclipse, Accord, Advance, and Omni. Have you ever tried one of these products?	Current and former smokers who quit within 5 years	
Yes		
No		
Q. Next are some questions about new types of tobacco products that have been recently introduced/Have you ever heard of a tobacco product called…		All respondents
Eclipse (Yes/No)		
Quest (Yes/No)		
Marlboro Ultra Smooth (Yes/No)		
Ariva (Yes/No)		
Revel (Yes/No)		
Q. Tobacco companies have also recently introduced new types of smokeless tobacco products. These have names like Arriva, Exalt, and Revel. Have you ever tried one of these products?	Current and former smokers who quit within 5 years	
Yes		
No		
Q. Have you ever heard of any other types of new tobacco product? These would include products like Accord, Advance, Omni, Exalt, and Stonewall.		All respondents
Yes		
No		
Q. What other new products have you heard of?		All respondents
Accord		
Advance		
Omni		
Exalt		
Stonewall		
Other (specify)		
Q. You said that you have heard of (fill in with answer/s above). Have you ever tried (this/these product/s)?		Respondents who have heard of a PREP
Yes		
No		
Q. Which one/s?		Respondents who have tried a PREP
Accord		
Advance		
Ariva		
Eclipse		
Exalt		
Marlboro Ultra Smooth		
Omni		
Quest		
Revel		
Stonewall		
Other (specified in answer above)		

Note. PREPs = potential reduced-exposure tobacco products; HINTS = Health Information National Trends Survey.

To further understand factors influencing interest in PREPs, we analyzed the interest variable, using a combined HINTS 2003 and 2005 dataset, in relation to a range of demographic (age, gender, employment status, marital status, education, and race/ethnicity) and health belief and behavior variables (smoking frequency, cigarettes per day, interest in quitting, perceived cancer risk, and attitudes regarding cancer preventability). Finally, three statements were included in HINTS to measure preventability or fatalism: "It seems like almost everything causes cancer"; "There's not much people can do to lower their chances of getting cancer"; "There are so many different recommendations about preventing cancer, it's hard to know which ones to follow" (strongly agree, somewhat agree, somewhat disagree, strongly disagree). In HINTS 2005, these three preventability/fatalism questions and the cancer worry question specified a particular type of cancer rather than asking about cancer in general; each respondent was asked about one of three cancers (lung, skin, or colon) randomly determined.

Statistical procedures

Data were weighted to produce overall and stratified estimates that would be nationally representative of the U.S. population. Every sampled adult who completed a HINTS questionnaire received a final sampling weight. The sampling weights were derived to adjust for oversampling and nonresponse and were calibrated using comparable population characteristics for sex, age, race, and education from data publicly available through the March 2001 Tobacco Use Supplement to the Current Population Survey (Davis, Park, Covell, Rizzo, & Cantor, 2005).

To account for the multistage sample design of HINTS, we used SAS-callable SUDAAN to calculate population estimates and confidence intervals (CIs). We used cross tabulation with chi-square tests for categorical variables to examine bivariate associations between the outcome variables of awareness and interest in using a PREP by the independent variables described above. We also performed a logistic regression for the two-level variable of interest in trying a PREP. We included key demographic variables (gender, age, race/ethnicity, education) in the model along with self-reported general health, interest in quitting, and the three fatalism/preventability questions described above. The aim of the multivariate analysis was to determine whether positive relationships with interest in quitting and fatalism/preventability observed in the univariate analysis would still be evident when controlling for demographic and other variables.

Results

Awareness of PREPs (HINTS 2005 only)

Results from HINTS 2005 indicated that 45% of respondents had heard of at least one of the PREPs included in the survey. Awareness was substantially higher among current smokers (55.6%) than among former smokers (45.2%) and never-smokers (40.7%). Awareness also differed substantially as reported across brands. Reported awareness was highest for MUS (30.2%), Eclipse (18.2%), Quest (7.8%), Ariva (5.4%), Revel (2.2%), and Advance (1.2%), while less than 1% for any other product (Accord, Omni, Exalt, Stonewall). Brand awareness is depicted in Figure 1. Nineteen respondents named other "new tobacco products" they had heard of, but most of these products were named by only one respondent and did not correspond to recognizable PREP brands. Because MUS entered test markets while the HINTS 2005 survey was in the field (O'Connell, 2005), we compared awareness of MUS in test market zip codes (Atlanta, Tampa, and Salt Lake City) versus other areas of the country; reported awareness of MUS was actually greater in non–test market zip codes than in the test market areas (28.3% vs. 20.7%), although the number of respondents in the test market areas (29) was small. No significant differences in overall PREP awareness were found by employment status, education level, age, gender, or race/ethnicity.

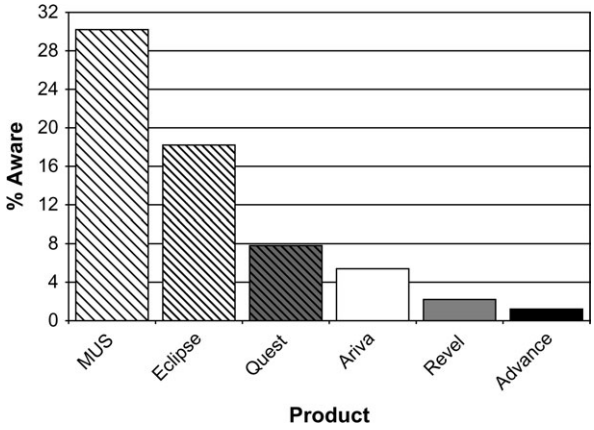

Figure 1. Brand Awareness, HINTS 2005.

Trial and use of PREPs (HINTS 2003 and 2005)

Because questions about trial and use of PREPs were asked differently and of different populations in HINTS 2003 and 2005, we report the two survey waves separately here. In HINTS 2003, 5.6% ($n = 82$) of ever-smokers (including 5.9% [$n = 77$] of current smokers and 3.3% [$n = 5$] of former smokers) had tried some form of PREP. When divided by type of PREP product, 4% ($n = 69$) of ever-smokers (including 4.8% [$n = 62$] of current smokers and 1.6% [$n = 7$] of former smokers) reported that they had tried a cigarette-type PREP, while only 1.5% ($n = 24$) of ever-smokers (including 1.7% [$n = 21$] of current smokers and 0.8% [$n = 3$] of former smokers) had tried a smokeless tobacco–type PREP.

In HINTS 2005, 4.8% of all respondents had tried a PREP. Current smokers were substantially more likely to have tried a PREP (12.7%) compared with former smokers (1.9%) and never-smokers (1.7%). Among the 93 respondents who had tried a PREP, only half (46) provided the product brand name when asked. The only PREP products respondents reported having used were MUS (35%), Eclipse (30%), and Quest (24%). Five other products were named by respondents as PREPs they had tried, but each of these was named by only one participant and none corresponded to any known PREP brand.

In HINTS 2005, of the 93 respondents who reported having tried a PREP product, 89 answered additional questions about their use and beliefs about that product. The remaining 4 either declined to answer the question or reported that they did not know the answer to the follow-up questions. Only 8% (7 people) of those who had tried a PREP said they continued to use the product every day or some days. However, more than half

(51.2%) said they smoked less of their usual brand or stopped smoking it entirely while using the PREP. Half of those who had tried a PREP reported that their main reason for trying or using the product was to reduce health risks (30.1%) or to help them quit smoking (19.2%). The rest cited other reasons, including taste, lower cost, and curiosity. One third (32.6%) of those who had tried a PREP said that they believed the product was less harmful than conventional cigarettes, while 49% said it was equally harmful and 9% said it was more harmful.

Interest in PREPs (HINTS 2003 and 2005)

In the combined HINTS 2003/2005 dataset, 54.4% of current smokers reported that they would be "very" or "somewhat" interested in trying a cigarette advertised as less harmful, while only 3.2% of former smokers and 1.1% of never-smokers were interested. In HINTS 2003, only 59.2% of current smokers stated they were very or somewhat interested in trying a PREP, while in HINTS 2005, this number dropped to 49.8%. We examined a range of potential correlates of interest in PREPs among current smokers in the combined HINTS 2003/2005 dataset, including variables related to demographics, smoking behavior, and attitudes and beliefs about cancer; these results are described below and in Table 3.

Demographics and smoking behavior (current smokers only: HINTS 2003 and 2005). Female smokers were more likely to be interested in PREPs than males (59.3% vs. 49.9%; $p = .001$). No significant trend was observed across multiple age categories; older smokers, 35 years old and over, appeared more likely to be interested than smokers 18 to 34 years old (56.7% vs. 50.4%), though this difference was not statistically significant ($p = .09$). A higher proportion of non-Hispanic Whites (57.1%) reported being interested in trying new tobacco products than did Hispanic (45.8%) and Black (40.6%) respondents; in direct pairwise comparisons, these differences were statistically significant. Due to limited sample size for the remaining racial/ethnic categories, respondents who reported that they were Asian or Native American or did not identify themselves in a given race/ethnic group were collapsed into a single category (Other, non-Hispanic). This group showed an overall level of interest in PREPs similar to non-Hispanic whites (63.2%), although the numbers were too small to further stratify this group. Employment status, marital status, and education did not show any significant association with interest among smokers.

Differences were observed in relation to smoking status as well. Daily smokers were substantially more likely to be interested than those who smoked only on some days (58.2% vs. 41.6%; $p \leq .001$). Those who smoked 20 or more cigarettes per day were more likely to be interested than those who smoked less than 20, though this difference was not statistically significant (61.4% vs. 55.3%; $p = 0.068$). Contemplating quitting smoking was inversely associated with interest; smokers who reported they were seriously considering quitting were actually less likely to be interested in PREPs than those who were not considering quitting (59.5% vs. 51.7%; $p \leq .05$). The HINTS 2003 survey also asked smokers of light, ultra-light, and other non–full-flavor cigarettes their reason for selecting that brand. Within the HINTS 2003 data, only current smokers who reported smoking their usual type of cigarette in order to reduce health risks or to try to quit smoking were more likely to be interested in trying new cigarettes (78.3% and 65.4%, respectively) than were smokers who reported other reasons, such as taste, for smoking their usual type of cigarette (58.3%).

Cancer preventability and fatalism (current smokers only: HINTS 2003 and 2005). Smokers who reported that they perceived their lung cancer risk as "high" were more likely to be interested in PREPs than those who described their risk as "medium" or "low" (59.2% vs. 49.8%; $p \leq .01$). Smokers who reported a prior cancer diagnosis were more likely to be interested than those who did not, though this difference was not statistically significant (60.9% vs. 53.7%; $p = .089$). And in separate analyses, in both HINTS 2003 and 2005, smokers who worry about cancer more often (sometimes, often, all the time) were more likely to be interested than those who worry about cancer rarely or never. Self-reported general health status and seeking cancer information did not show any relationship with interest.

Smokers who endorsed statements consistent with fatalism and lack of ability to prevent cancer expressed higher levels of interest in trying a PREP than did those who disagreed with these statements. Those who agreed with the statement "It seems like almost everything causes cancer" were more likely to report interest in PREPs than those who did not agree (61.9% vs. 50.6%; $p \leq .001$). Similarly, those who endorsed the statement "There's not much people can do to lower their chances of getting cancer" were more likely to be interested than those who did not (62% vs. 51.8%; $p \leq .01$). Finally, smokers who agreed with the statement "There are too many different recommendations about preventing cancer" were more likely to be interested than those who did not (58.9% vs. 46.7%; $p \leq .001$).

Multivariate logistic regression (current smokers only: HINTS 2003 and 2005)

Most of the positive relationships observed in the bivariate analyses of correlates of interest were also observed in the multivariate regression analysis controlling for sociodemographic factors and other potentially relevant variables. A positive relationship was found between female gender and interest in trying a PREP (odds ratio [OR] 1.47, 95% CI = 1.15–1.87, $p \leq .01$). A negative association was found between Black or Hispanic race/ethnicity and interest (Black: OR 0.5, 95% CI = 0.35–0.72, $p \leq .001$; Hispanic OR 0.64, 95% CI = 0.41–0.98, $p \leq .001$). Additionally, smokers who were not considering quitting were more likely to be interested in trying a PREP when controlling for sociodemographic and other factors (OR 1.39, 95% CI = 1.05–1.84, $p \leq .05$). The positive relationships between interest and fatalistic or lack of preventability attitudes demonstrated the same pattern when controlling for other factors, although one of the three ("There's not much people can do to lower their chances of getting cancer") was no longer statistically significant. Cancer worry did not exhibit a significant trend in the multivariate model. The multivariate logistical regression analysis is reported in Table 4.

Discussion

Our findings suggest that there is substantial awareness of PREPs among U.S. adults, although prevalence of use of these products remains relatively low. However, interest in PREPs among current smokers is very high. Of particular concern is that "health conscious" smokers may be especially vulnerable to PREP marketing messages; half of those who tried a PREP did so to reduce harm or assist in quitting, and interest in PREPs was

Table 3. Interest in PREPs among current smokers, by sociodemographic variables, smoking frequency, and health attitudes: HINTS 2003 and 2005

	Very or somewhat interested		Not interested	
	N	% (*CI*)	*N*	% (*CI*)
Total	1269	54.4 (51.3, 57.3)	979	45.6 (42.7, 48.7)
Gender				
Male	491	49.9 (45.4, 54.5)**	459	50.1 (45.5, 54.6)**
Female	778	59.3 (55.8, 62.8)**	520	40.7 (37.2, 44.2)
Age group				
18–34	328	50.4 (44.5, 56.3)	300	49.6 (43.7, 55.5)
35+	935	56.7 (53.0, 60.2)	677	43.3 (39.8, 47.0)
Race/ethnicity				
White, non-Hispanic	926	57.1 (53.5, 60.7)***	626	42.9 (39.3, 46.5)***
Black, non-Hispanic	111	40.6 (32.5, 49.2)***	133	59.4 (50.8, 67.5)***
Hispanic	115	45.8 (37.0, 54.8)***	124	54.2 (45.2, 63.0)***
Other, non-Hispanic	87	63.2 (51.8, 73.3)***	59	36.8 (26.7, 48.2)***
Education				
<12 years	198	53.8 (46.4, 60.9)	162	46.2 (39.1, 53.6)
12 years	477	56.3 (51.3, 61.2)	344	43.7 (38.8, 48.7)
12+ years	575	53.3 (48.9, 57.6)	448	46.7 (42.4, 51.1)
Cigarettes/day				
1–19	492	55.3 (50.7, 59.8)*	364	44.7 (40.2, 49.3)*
20+	551	61.4 (56.7, 65.8)*	309	38.6 (34.2, 43, 3)*
Smoking frequency				
Daily	1044	58.2 (55.0, 61.4)***	676	41.8 (38.6, 45.0)***
Non-daily	225	41.6 (36.2, 47.1)***	303	58.4 (52.9, 63.8)***
Considering quitting smoking				
Yes	801	51.7 (47.4, 56.0)*	681	48.3 (44.0, 52.6)*
No	468	59.5 (55.2, 63.6)*	298	40.5 (36.4, 44.8)*
Have tried a PREP				
Yes	96	60.9 (50.5, 70.4)	54	39.1 (29.6, 49.5)
No	1166	53.9 (50.6, 57.1)	920	46.1 (42.9, 49.4)
Worry about getting cancer				
Rarely or Never	328	25.2 (21.9, 28.8)**	1087	74.8 (71.2, 78.1)**
Sometimes	255	33.9 (28.6, 39.6)**	584	66.1 (60.4, 71.4)**
Often	62	33.9 (24.7, 44.5)**	98	66.1 (55.5, 75.3)**
All the time	32	39.5 (23.9, 57.7)**	40	60.5 (42.3, 76.2)**
Worry about getting colon/lung/skin cancer				
Rarely or Never	366	11.4 (10.0, 12.9)**	3633	88.6 (87.1, 90.0)**
Sometimes	151	14.9 (12.0, 18.4)**	924	85.1 (81.6, 88.0)**
Often	34	20.4 (13.0, 30.5)**	138	79.6 (69.6, 87.0)**
All the time	32	21.8 (14.8, 31.0)**	85	78.2 (69.0, 85.2)**
Perceived lung cancer risk				
High	226	59.2 (51.9, 66.1)**	126	40.8 (33.9, 48.1)**
Medium/Low	304	49.8 (44.2, 55.5)**	261	50.2 (44.5, 55.8)**
Ever diagnosed with lung cancer				
Yes	163	60.9 (52.6, 68.7)	98	31.9 (31.3, 47.7)
No	1095	53.7 (50.4, 56.9)	876	46.3 (43.1, 49.6)
General health				
Excellent–Very Good	374	54.7 (49.8, 59.5)	293	45.3 (40.5, 50.2)
Good	489	55.0 (50.4, 59.6)	350	45.0 (40.4, 49.6)
Fair–Poor	391	53.9 (48.0, 59.7)	316	46.1 (40.3, 52.0)
"It seems like everything causes cancer"				
Agree	545	61.9 (56.6, 66.9)***	314	38.1 (33.1, 43.4)***
Disagree	718	50.0 (46.5, 53.5)***	659	50.0 (46.5, 53.5)***
"One cannot lower their chance of getting cancer"				
Agree	357	62.0 (56.3, 67.4)**	213	38.0 (32.6, 43.7)**
Disagree	906	51.8 (48.4, 55.2)**	760	48.2 (44.8, 51.6)**
"There are too many recommendations to prevent cancer"				
Agree	877	58.9 (55.2, 62.5)***	580	41.1 (37.5, 44.8)***
Disagree	386	46.7 (41.7, 51.8)***	393	53.3 (48.2, 58.3)***

Note. PREPs = potential reduced-exposure tobacco products; HINTS = Health Information National Trends Survey.
*$p \leq .05$, **$p \leq .01$, ***$p \leq .001$.

Table 4. Multivariate logistic regression predicting interest in PREPs among current smokers, by sociodemographic variables and heath attitudes, HINTS 2003 and 2005

	OR (95% *CI*)
Gender	
Male	1.00
Female	1.47 (1.15, 1.87)**
Age group (years)	
18–34	1.00
35–39	1.22 (0.78, 1.91)
40–44	1.34 (0.87, 2.06)
45+	1.14 (0.82, 1.58)
Race/ethnicity	
White, non-Hispanic	1.00
Black, non-Hispanic	0.50 (0.35, 0.72)***
Hispanic	0.64 (0.41, 0.98)***
Other, non-Hispanic	1.35 (0.80, 2.29)***
Education	
<12 years	1.02 (0.69, 1.48)
12 years	1.06 (0.82, 1.37)
12+ years	1.00
Considering quitting smoking	
Yes	1.00
No	1.39 (1.05, 1.84)*
General health	
Excellent–Very Good	1.00
Good	0.97 (0.73, 1.29)
Fair–Poor	0.89 (0.64, 1.24)
"It seems like everything causes cancer"	
Agree	1.40 (1.06, 1.85)*
Disagree	1.00
"One cannot lower their chance of getting cancer"	
Agree	1.31 (0.97, 1.77)
Disagree	1.00
"There are too many recommendations to prevent cancer"	
Agree	1.44 (1.08, 1.92)*
Disagree	1.00

Note. PREPs = potential reduced-exposure tobacco products; HINTS = Health Information National Trends Survey.

*$p \leq .05$, **$p \leq .01$, ***$p \leq .001$.

higher among smokers who view themselves at higher risk for lung cancer. At the same time, interest was higher among daily smokers not currently considering quitting and among those who exhibited more fatalistic attitudes toward their ability to prevent cancer.

Our results are consistent with previous surveys, suggesting that smokers' interest in trying PREPs is high, particularly among "health conscious" smokers (Hund et al., 2006; Shiffman et al., 2004; Steinik, 2004). However, some focus group studies that queried smokers in more detail about their expectations and interest in PREPs have found that this initial "interest" is not robust. In particular, smokers expressed doubt about PREP health claims, whether they would actually switch to a PREP product, and whether PREPs would taste as good as conventional cigarettes (Caraballo et al., 2006; Health Canada, 2003; Lau, Kreslake, & Carpenter, 2006). In a previous study using data from a marketing survey, we found that while personal health concerns were associated with interest in PREPs, specific consumer behaviors, such as favorable attitudes toward technology and a willingness to try new products and trends, were also important factors (Parascandola, Hurd, & Augustson, 2008). Thus, smokers' beliefs about and reasons for interest in PREPs appear to be complex and multifaceted.

The finding that smokers who expressed fatalistic attitudes toward their cancer risk were more likely to be interested in PREPs was surprising and may appear counterintuitive; if smokers are interested in PREPs as a means of reducing their risk, one might expect them to be more optimistic about their potential for risk reduction. One possible explanation is that smokers who are interested in PREPs are smokers who have tried to quit and failed and are frustrated with their inability to modify their behavior. A study of risk perception in smokers using data from HINTS 2003 found that smokers tend to underestimate their risks and overemphasize their ability to minimize those risks (Weinstein, Marcus, & Moser, 2005); however, smokers who are interested in PREPs may differ in their attitudes and beliefs compared with other smokers. Attitudes about preventability of cancer may also be related to other general health attitudes, such as aversion to ambiguity and cancer fatalism (Han, Moser, & Klein, 2006; Powe & Finnie, 2003). More in-depth exploration of smokers' reasons for interest in PREPs and relation to other health attitudes and behaviors is needed, perhaps, using smaller studies and qualitative methods that allow for more in-depth questioning.

Relatively few people had actually tried a PREP product. This finding is also consistent with other findings in the literature that suggest that PREP products have not yet seen wide commercial availability and success, whether because of lack of interest among consumers or lack of investment by manufacturers (Caraballo et al., 2006; Hickman et al., 2004). In our study, of those who had tried a PREP, few continued to use the product, although half did state that they now smoked less of their usual cigarette (however, we cannot determine if a similar reduction also occurred among smokers who had not tried a PREP). This is consistent with the findings related to interest in PREPs that suggest that a substantial proportion of smokers are interested in trying new products for novelty reasons. In the HINTS dataset, there was a substantial apparent increase in the proportion of smokers who reported they had tried a PREP between 2003 and 2005. The small number of respondents who had tried a PREP in either wave (62 in HINTS 2003 and 93 in HINTS 2005) allows for random variation. Additionally, the difference in how the question was asked across the two survey waves may have influenced this outcome. In HINTS 2005, a longer list of brand names was provided. Of those who reported a product name they had tried, more than half named Quest or MUS, which were introduced after the first HINTS survey was in the field. It may also be likely that a substantial proportion of those who reported use of MUS may have been thinking of a conventional Marlboro brand.

There are limitations to the HINTS dataset that should inform future surveillance activities around PREPs. Because some questions were asked of only smokers or were asked of only half of the respondents, the power of our study was limited for some analyses, and some comparisons could not be

drawn. For example, more than half of those who had tried a PREP said they now smoked less of their usual brand or had stopped smoking it entirely. However, because this question was asked of only those who had tried a PREP, we were not able to test whether this smoking reduction was limited to PREP users (and possibly attributable to PREP use) or occurred among other smokers as well.

We also concluded that estimates of brand awareness should be interpreted cautiously, as some brands (such as Eclipse and MUS) have names that are similar to those of other, more widely available consumer products. MUS first appeared in test markets (Atlanta, Tampa, Salt Lake City) in early 2005 (around the same time as the Q1 wave of our survey) accompanied by national media coverage (O'Connell, 2005). However, given the limited availability and marketing of the product (Giovino et al., 1994), a substantial portion of the awareness and use reported may in fact be due to misreporting based on the familiarity of the Marlboro name. Our finding that reported awareness of MUS was higher outside test market areas provides further support for this conclusion. These observations should inform development of product-specific questions in future surveys.

Nevertheless, these findings have some important implications for tobacco control efforts. The high reported awareness of MUS suggests that brand name recognition may be an important factor in marketing of PREPs. It is important to note that last year both Philip Morris and R. J. Reynolds introduced new smokeless tobacco products using the familiar brand names Marlboro and Camel (Feder, 2007). Other studies suggest that consumers may draw conclusions about a PREP's relative safety based on advertisements, even when no explicit health claims are made (Biener, Bogen, & Connolly, 2007; Hamilton et al., 2004; O'Connor et al., 2005; O'Hegarty, Richter, & Pederson, 2007). Thus, consumer awareness of and interest in PREPs may be modified substantially by brand name and other factors independently of exposure or risk reduction claims. Future surveillance of PREP products and advertising should take this into account. Additionally, the finding that individuals who are interested in PREPs are concerned about their health but also pessimistic about their ability to quit suggests that there is a segment of smokers not being reached successfully by current tobacco control efforts who are vulnerable to marketing of PREPs. It is important to identify the barriers to quitting in this group and to be aware of the impact PREPs may have on quitting behavior.

Marketing of these new tobacco products remains limited at this time, and the introduction of new products into the market is a dynamic process. While our survey provides important baseline prevalence information about trends in awareness, use, and interest in PREPs, this study should be followed by periodic surveillance activities, including more targeted surveys in test markets and in populations where awareness and use is likely to be high. Future development of large-scale surveys like HINTS should be complemented and informed by smaller focus groups and targeted surveys that allow more in-depth questioning. Moreover, in the absence of meaningful regulation of marketing claims, data collected in HINTS provide a unique resource for monitoring public perceptions and understanding of the risks of PREPs.

Funding

None declared.

Declaration of Interests

None declared.

Acknowledgments

We are indebted to William Waldron and Rick Moser for assistance with the analysis and to Gary Giovino, Lois Beiner, and David Nelson for comments on the survey development and on earlier versions of this analysis. Mary E. O'Connell and Erik Augustson were funded in whole or in part with federal funds from the National Cancer Institute, National Institutes of Health, under contract N01-CO-12400. The content of this publication does not necessarily reflect the views or policies of the Department of Health and Human Services nor does mention of trade names, commercial products, or organizations imply endorsement by the U.S. Government.

References

Biener, L., Bogen, K., & Connolly, G. (2007). Impact of corrective health information on consumers' perceptions of "reduced exposure" tobacco products. *Tobacco Control*, *16*, 306–311.

Borland, R., Yong, H. H., King, B., Cummings, K. M., Fong, G. T., Elton-Marshall, T., et al. (2004). Use of and beliefs about light cigarettes in four countries: Findings from the International Tobacco Control Policy Evaluation Survey. *Nicotine & Tobacco Research*, *6*(Suppl. 3), S311–S321.

Caraballo, R. S., Pederson, L. L., & Gupta, N. (2006). New tobacco products: Do smokers like them? *Tobacco Control*, *15*, 39–44.

Chang, L. and Krosnick, J. A. (2002). A Comparison of the Random Digit Dialing Telephone Survey Methodology with Internet Survey Methodology as Implemented by Knowledge Networks and Harris Interactive. *Paper presented at the annual meeting of the American Political Science Association, Boston Marriott Copley Place, Sheraton Boston & Hynes Convention Center, Boston, MA*. Retreived 19 May 2009, from http://www.allacademic.com/meta/p66294_index.html

Cummings, K. M., Hyland, A., Bansal, M. A., & Giovino, G. A. (2004). What do Marlboro Lights smokers know about low-tar cigarettes? *Nicotine & Tobacco Research*, *6*(Suppl. 3), S323–S332.

Davis, T., Park, I., Covell, J., Rizzo, L., & Cantor, D. (2005). *Health Information National Trends Survey (HINTS) 2005: Final Report*. Bethesda, MD: U.S. Department of Health and Human Services, National Institutes of Health, National Cancer Institute. Retrieved August 22, 2007, from http://hints.cancer.gov/docs/HINTS2005FinalReport-0523.pdf

Feder, B. J. (2007, June 9). Philip Morris tries smokeless tobacco product. *The New York Times.* Retrieved 19 May 2009, from http://www.nytimes.com/2007/06/09/business/09smoke.html#

Giovino, G. A., Schooley, M. W., Zhu, B. P., Chrismon, J. H., Tomar, S. L., Peddicord, J. P., et al. (1994). Surveillance for selected tobacco-use behaviors—United States, 1900–1994. *MMWR CDC Surveillance Summaries*, *43(3),* 1–43.

Hamilton, W. L., Norton, G., Ouellette, T. K., Rhodes, W. M., Kling, R., & Connolly, G. N. (2004). Smokers' responses to advertisements for regular and light cigarettes and potential reduced-exposure tobacco products. *Nicotine & Tobacco Research*, *6*(Suppl. 3), S353–S362.

Han, P. K., Moser, R. P., & Klein, W. M. (2006). Perceived ambiguity about cancer prevention recommendations: Relationship to perceptions of cancer preventability, risk, and worry. *Journal of Health Communication*, *11*(Suppl. 1), 51–69.

Health Canada. (2003). *Consumer interest in potential reduced exposure products: Results of a Focus Group Study. Final Report.* Ottawa: Health Canada.

Health Communication and Informatics Research Branch of the Division of Cancer Control and Population Sciences. (2006). *Health Information National Trends Survey (HINTS)*. Retrieved 19 May 2009, from http://hints.cancer.gov/ U.S. Bethesda, MD: Department of Health and Human Services, National Institutes of Health, National Cancer Institute.

Hickman, N., Klonoff, E. A., Landrine, H., Kashima, K., Parekh, B., Fernandez, S., et al. (2004). Preliminary investigation of the advertising and availability of PREPs, the new "safe" tobacco products. *Journal of Behavioral Medicine*, *27*, 413–424.

Hund, L. M., Farrelly, M. C., Allen, J. A., Chou, R. H., St Claire, A. W., Vallone, D. M., et al. (2006). Findings and implications from a national study on potential reduced exposure products (PREPs). *Nicotine & Tobacco Research*, *8*, 791–797.

Joseph, A. M., Hennrikus, D., Thoele, M. J., Krueger, R., & Hatsukami, D. (2004). Community tobacco control leaders' perceptions of harm reduction. *Tobacco Control*, *13*, 108–113.

Kozlowski, L. T., Goldberg, M. E., Yost, B. A., White, E. L., Sweeney, C. T., & Pillitteri, J. L. (1998). Smokers' misperceptions of light and ultra-light cigarettes may keep them smoking. *American Journal of Preventive Medicine*, *15*, 9–16.

Lau, T., Kreslake, J., & Carpenter, C. (2006). *Consumer perception of advertising and packaging for Marlboro UltraSmooth: Preliminary focus group results*. Boston, MA: Tobacco Control Research Program, Division of Public Health Practice, Harvard School of Public Health.

Martin, E. G., Warner, K. E., & Lantz, P. M. (2004). Tobacco harm reduction: What do the experts think? *Tobacco Control*, *13*, 123–128.

National Cancer Institute. (2001). *Risks associated with smoking cigarettes with low machine-measured yields of tar and nicotine. Smoking and Tobacco Control Monograph No. 13.* Bethesda, MD: Department of Health and Human Services, National Institutes of Health, National Cancer Institute. (NIH Publication No. 02–5074).

Nelson, D. E., Kreps, G. L., Hesse, B. W., Croyle, R. T., Willis, G., Arora, N. K., et al. (2004). The Health Information National Trends Survey (HINTS): Development, design, and dissemination. *Journal of Health Communication*, *9*, 443–460. Discussion 481–444.

O'Connell, V. (2005, January 21). Marlboro cigarette avoids 'safer' claim, but scrutiny arises. *Wall Street Journal*, Section B21.

O'Connor, R. J., Hyland, A., Giovino, G. A., Fong, G. T., & Cummings, K. M. (2005). Smoker awareness of and beliefs about supposedly less-harmful tobacco products. *American Journal of Preventive Medicine*, *29*, 85–90.

O'Hegarty, M., Richter, P., & Pederson, L. L. (2007). What do adult smokers think about ads and promotional materials for PREPs? *American Journal of Health Behavior*, *31*, 526–534.

Parascandola, M., Hurd, A. L., & Augustson, E. (2008). Consumer awareness and attitudes related to new potential reduced-exposure tobacco products. *American Journal of Health Behavior*, *32*, 431–437.

Pederson, L. L., & Nelson, D. E. (2007). Literature review and summary of perceptions, attitudes, beliefs, and marketing of potentially reduced exposure products: communication implications. *Nicotine & Tobacco Research*, *9*, 525–534.

Powe, B. D., & Finnie, R. (2003). Cancer fatalism: The state of the science. *Cancer Nursing*, *26*, 454–465. Quiz 466–457.

Shiffman, S., Pillitteri, J. L., Burton, S. L., & Di Marino, M. E. (2004). Smoker and ex-smoker reactions to cigarettes claiming reduced risk. *Tobacco Control*, *13*, 78–84.

Shiffman, S., Pillitteri, J. L., Burton, S. L., Rohay, J. M., & Gitchell, J. G. (2001). Smokers' beliefs about "light" and "ultra light" cigarettes. *Tobacco Control*, *10*(Suppl. 1), i17–i23.

Steinik, M. (2004). *The path to a safer cigarette: Potentially reduced exposure products (PREPs)*. New York: JP Morgan Global Equity Research.

Stratton, K., Shetty, P., Wallace, R., & Bondurant, S. (2001). Clearing the smoke: The science base for tobacco harm reduction—executive summary. *Tobacco Control*, *10*, 189–195.

United States Postal Service. (2007). *Zip code lookup*. Retrieved 22 August 2007, from http://zip4.usps.com/zip4/welcome.jsp

Warner, K. E., & Martin, E. G. (2003). The US tobacco control community's view of the future of tobacco harm reduction. *Tobacco Control*, *12*, 383–390.

Weinstein, N. D., Marcus, S. E., & Moser, R. P. (2005). Smokers' unrealistic optimism about their risk. *Tobacco Control*, *14*, 55–59.